Note respecting the Printing of Tabular Matter in the Society's Publications.

The Secretaries wish to draw the attention of Fellows who submit papers for publication in the *Memoirs* or *Monthly Notices* to the importance of drawing up tabular matter so as to fit the size of page as nearly as possible. Care in this respect will avoid the necessity which has sometimes arisen of printing tables the wrong way of the page. For example, a convenient form in which observations of double stars may be printed in the *Memoirs* will be found in *Mem.* vol. liii. pp. 294–307, and similarly for the *Monthly Notices* in *M.N.* vol. lxi. pp. 486–500. The form in the *Monthly Notices* may be taken as showing the maximum number of columns which can be printed on a page. As a rule, notes are best printed at the bottom of the page or at the end of a paper.

[Secretaries.]

Determination of Dr. Küstner's Magnitude Equation from Comparison of his Meridian Observations in Zones +24° to +27° with Measures of Photographic Plates taken at the University Observatory, Oxford. By H. H. Turner, D.Sc., F.R.S., Savilian Professor.

1. Dr. F. Küstner, Director of the Bonn Observatory, has embarked on a fine piece of work which he describes in the following terms: the formation of a catalogue of a number of stars of all magnitudes from the 4th to the 10th, uniformly distributed over the sky, reduced to the system of the Fundamental Catalogue of the *Astronomische Gesellschaft*, special attention being given to the determination and elimination of the magnitude equation in both R.A. and declination, and both of the fundamental catalogue and of the observer himself. Two parts of this work have already appeared.* The first gives a catalogue of 4,070 stars in zones 0° to +18°, and the second a catalogue of 4,292 stars in zones +18° to +36°. The zones under survey at the University Observatory, Oxford, as part of the astrographic chart work extend from +24° to +32° (plate centres +25° to +31°), and the zones with centres +25° +26° +27° are complete, while those with centres +28° and +29° will probably be completed by the end of this year (thirty plates are yet unfinished). There is thus considerable material for

* *Veröffentlichungen der königl. Sternwarte zu Bonn*, Nos. 4 and 5.

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comparison with Dr. Küstner's observations already, though a complete comparison cannot be made for a year or two. Since Dr. Küstner is directing special attention to the magnitude equation, which he investigates by the method of screens (cutting down the light of the bright stars for some transits and leaving it unobscured in others), it is of interest to give at once the totally independent determination afforded by photographic measures, which can be made with very little trouble.

2. In former papers (*Monthly Notices*, vol. lvii. p. 473, and vol. lx. p. 3) the magnitude equation of the Cambridge meridian observations was determined by comparison with Oxford photographic measures. The variation per magnitude was $0^s.023$ for stars brighter than magnitude 8·0, but much more rapid (about $0^s.100$) for fainter stars. In a note to the second paper (vol. lx. p. 11) it was stated that if the photographic method of determining magnitude equation were accepted as correct, the screen method seemed liable to underestimate the amount of the equation owing to difficulty in assigning the photometric value of the screen. It would have been interesting if the present comparison could have thrown further light on this point; but, unfortunately for this particular purpose, Dr. Küstner's magnitude equation is very small—practically zero. He obtains coefficients in R.A. of opposite signs in the two volumes published: for stars in zones 0° to +18° the result is $+0^s.0070$; for zones +18° to +36° the result is $-0^s.0041$; and it may be added that before beginning this work he got from the Victoria comparison stars the value $-0^s.0040$. The result obtained from the subjoined comparison is $+0^s.009$.

3. The comparison was effected as follows. In the course of the ordinary work at Oxford those stars which have been observed on the meridian at Cambridge, as part of the great catalogue of the *Astronomische Gesellschaft*, are used to get the plate constants. These being obtained, the residuals for the individual stars, in the sense Oxford – Cambridge, are entered in ledgers; and the mean of these residuals (for two or more separate plates as the case may be) is for the present purpose taken as the correction to the Cambridge place. The Cambridge places are given in the original catalogue for epoch 1875·0, but for use in our work they have been brought up to 1900·0, so that a comparison with Küstner (1900·0) is easily made. Adding then Oxford—Cambridge to Cambridge – Küstner we get Oxford – Küstner. The Cambridge places are thus nearly, but not quite, eliminated. Their influence remains in the means for all stars on a plate; if there were, for instance, a systematic error depending on R.A. running through the Cambridge Catalogue, this would remain in the Oxford photographic places. But since stars of all magnitudes would be equally affected this would not matter for our present purpose. The differences Oxford—Küstner for zones +24° to +27°, formed in this way, were grouped according to magnitude (as given by Küstner) and means taken as below. It

should be particularly remarked that *no observations made with screens were included in the comparison*, which is thus altogether independent of screens.

Comparison of Oxford (Photographic) – Küstner (Visual)
Zones $+24°$ *to* $+27°$ *only.*

Limits of Mag.	Adopted Mean Mag.	No. of Stars.	Oxford – Küstner. R.A. s	Oxford – Küstner. Dec. ″	O – K Corrected. R.A. s	O – K Corrected. Dec. ″
7·1 to 8·0	7·5	49	+0·138	−0·08	+0·014	+0·11
8·1 to 8·5	8·3	52	+ ·116	−0·24	−0·015	−0·13
8·6 & 8·7	8·65	35	+ ·132	−0·22	−0·003	−0·15
8·8 & 8·9	8·85	44	+ ·132	−0·05	−0·004	0·00
9·0 & 9·1	9·05	68	+ ·132	+0·02	−0·006	+0·04
9·2	9·2	44	+ ·136	0·00	−0·004	+0·01
9·3	9·3	37	+ ·148	+0·08	+0·007	+0·07
Over 9·3	9·6	38	+ ·156	+0·04	+0·013	0·00
Means ...	8·8	46	+ ·136	−0·05		

4. It is clear that the magnitude equation is very small, especially in R.A. If we assume a formula

$$a + b\ (\text{mag.} - 8{\cdot}8)$$

to represent the differences, and find a and b by "least squares," regarding the means for the groups as of equal weight, we get numerical values for b as follows :—

in R.A. $+0^{s}{\cdot}009$ in Dec. $+0''{\cdot}11$

Küstner's values are, from zones $+18°$ to $+36°$ (in which the zones $+24°$ to $+27°$, which form the basis of the above comparison, are included)

in R.A. $-0^{s}{\cdot}0041$ in Dec. $+0''{\cdot}064$

while from zones $0°$ to $+18°$ he got the results

in R.A. $+0^{s}{\cdot}0070$ in Dec. $+0''{\cdot}105$

In the columns of the above table headed "O – K corrected" the residuals of the previous columns are given after subtracting $+0^{s}{\cdot}136 + (m - 8{\cdot}8)\ 0^{s}{\cdot}009$ in R.A. and $-0''{\cdot}05 + (m - 8{\cdot}8)0''{\cdot}11$ in Decl.

5. As indicating the general accuracy of both sets of results (Küstner and Oxford), the following table showing the number of differences of various values may be interesting.

Individual Value of Oxford – Küstner.

In R.A.				In Decl.			
Value of Diff.	No. of Cases.	Value of Diff.	No. of Cases.	Value of Diff.	No. of Cases.	Value of Diff.	No. of Cases.
s		s		″		″	
−0·01	4	+0·16	25	−2·0	1	+0·1	22
0·00	1	+0·17	23	−1·9	2	+0·2	19
+0·01	2	+0·18	18	−1·3	1	+0·3	26
+0·02	3	+0·19	15	−1·2	5	+0·4	17
+0·03	3	+0·20	11	−1·0	2	+0·5	20
+0·04	8	+0·21	8	−0·9	9	+0·6	9
+0·05	6	+0·22	7	−0·8	8	+0·7	7
+0·06	7	+0·23	5	−0·7	19	+0·8	5
+0·07	15	+0·24	3	−0·6	15	+0·9	5
+0·08	19	+0·25	6	−0·5	20	+1·0	5
+0·09	16	+0·26	0	−0·4	29	+1·1	2
+0·10	25	+0·27	1	−0·3	20	+1·2	4
+0·11	17	+0·28	1	−0·2	35	+1·3	4
+0·12	24	+0·29	0	−0·1	24	+1·4	1
+0·13	34	+0·30	2	0·0	31		
+0·14	28	+0·31	1				
+0·15	28	+0·34	1				

General Conclusion.

Dr. Küstner's magnitude equation as determined by a comparison with Oxford photographic measures is in substantial agreement both in R.A. and Decl. with that found by him, using the method of screens; but the quantities are too small to settle the question whether the screen method is apt to give values which should be multiplied by a factor, as suggested in a former paper.

On Periodic Orbits in the Neighbourhood of Centres of Libration.

By H. C. Plummer, M.A.

1. It is well known that there are five exact solutions of the problem of three bodies in each of which the bodies preserve an unvarying configuration which revolves with a uniform velocity. It is also known that when the third body is of infinitesimal mass compared with the other two, it can describe small periodic orbits in the vicinity of the points where exact solutions exist. These points have been given by Gyldén the name of *centres of libration*, and a body describing an orbit of the kind indicated